

Analysis of streamflow gaging network in the Puget Sound Basin – Phase II

Chris Konrad
Washington Water Science Center
US Geological Survey
12 June 2013

Acknowledgements

The project was sponsored by the Association of Washington Cities and Washington Department of Ecology

The project was conducted in collaboration with Maria Sevier, who led the effort to digitize and QA/QC drainage area boundaries for this project.

Tasks and Products

Inspect and edit drainage area boundaries for active gages

- ArcGIS polygon shape file: ActiveGages.shp

Digitize drainage area boundaries for RSMP sites

- ArcGIS polygon shapefile: RSMP.shp

Compile physiographic and land use attributes for the Puget Sound basin, actively gaged areas, and RSMP areas

- Microsoft Excel file: PugetAttributes.xlsx

Tasks and Products (continued)

Identify attributes of the Puget Lowland that are not well represented by active gages

- This presentation

Identify active gages that are important for regional monitoring of small streams

- This presentation

Identify active gages that can be used in coordination with RSMP

- This presentation

Attributes

Elev	Mean elevation for the AU
Slope	Mean slope for the AU
PPT	Mean annual precipitation for the AU
StreamDen	Length of streams in AU divided by area of AU
GeoAluv	Fraction of AU where surficial geology is alluvium
GeoCoarse	Fraction of AU where surficial geology is coarse-grained, unconsolidated sediment
GeoFine	Fraction of AU where surficial geology is fine-grained, unconsolidated sediment
GeoRock	Fraction of AU where surficial geology is bedrock
Forest	Fraction of AU with deciduous, evergreen, or mixed forest (CCAP classes 9-11)
Wet	Fraction of AU with palustrine or estuarine wetlands (CCAP classes 13-18)
Imperv	Mean percent impervious cover in AU
RoadDen	Length of roads in AU divided by area of AU

Spatial Units

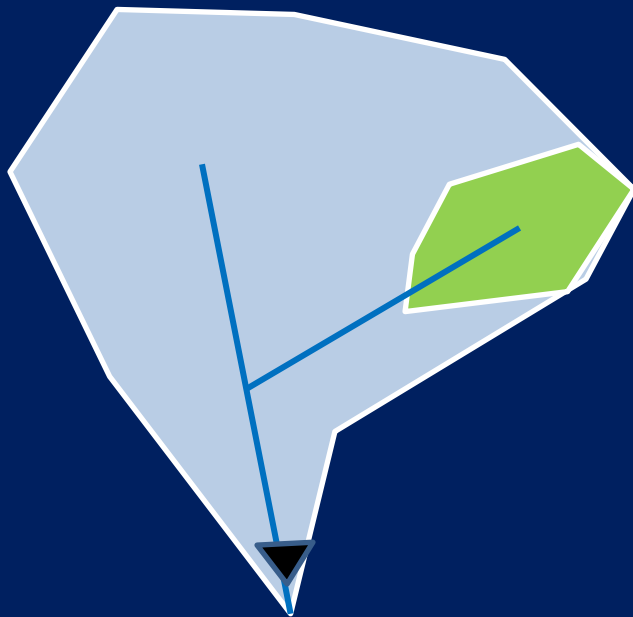
Washington Department of Ecology Watershed
Characterization Analysis Units

Drainage basins for active streamflow gages

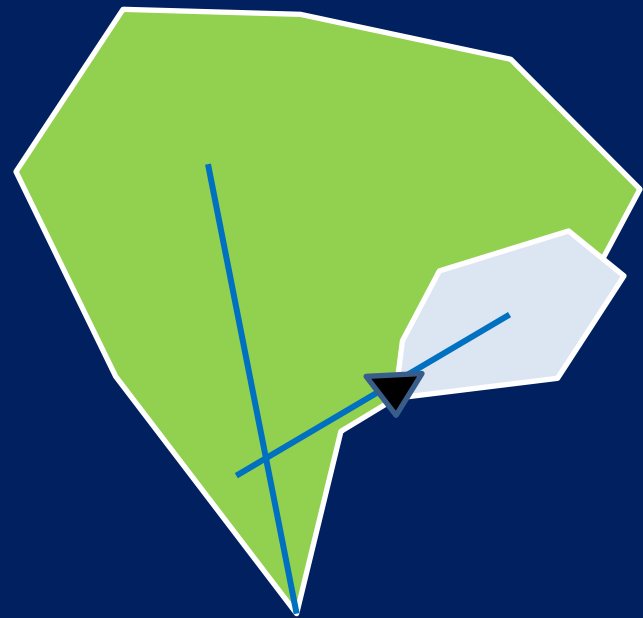
Drainage basins for RSMP sites

Standard for Assessing Utility of Gages for Regional Monitoring of Small Streams

A gage that covers at least 10 percent of a drainage area and that area is at least 10 percent of the gaged area.



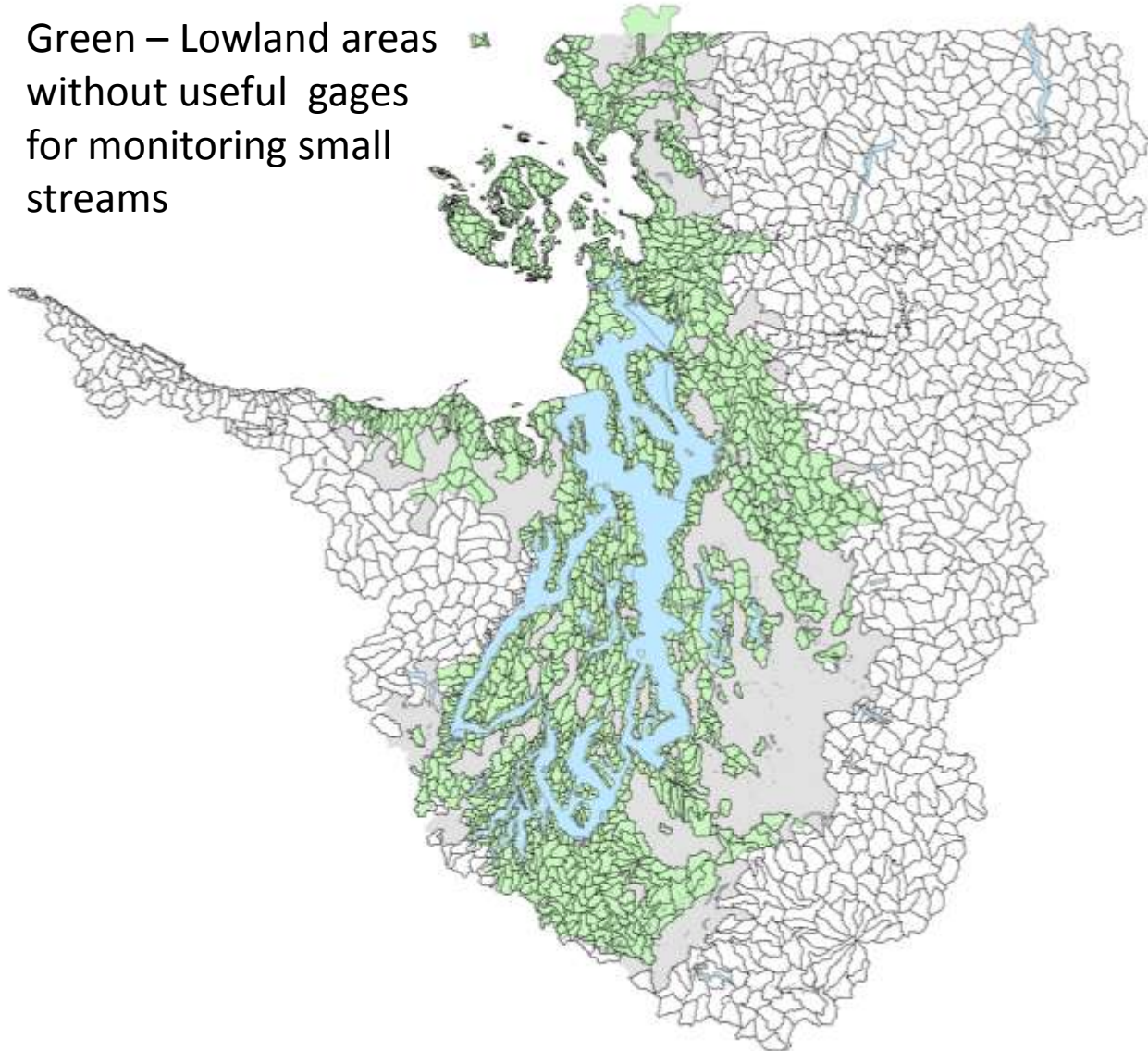
Area of interest is at least
10 percent of gage area



Gage is at least 10 percent
of the area of interest

Gaging Network Gaps In the Puget Lowland

Green – Lowland areas
without useful gages
for monitoring small
streams



Percentiles of lowland analysis units for each attribute

	Elevation	Slope	Precipitation	Stream Density	Aluvium	Coarse-grained	Fine-grained	Bedrock	Forest	Wetland	Impervious
Quantiles	meters	percent	meters per year	km per sq km	Fraction	Fraction	Fraction	Fraction	Fraction	Fraction	Percent
1	27	3	0.68	0.14	0.00	0.00	0.00	0.00	0.12	0.01	0
2	39	5	0.80	0.62	0.00	0.00	0.12	0.00	0.24	0.01	1
3	49	7	0.96	0.83	0.00	0.05	0.27	0.05	0.37	0.02	2
4	62	8	1.04	1.07	0.00	0.10	0.42	0.10	0.50	0.03	2
5	75	10	1.10	1.36	0.01	0.16	0.52	0.16	0.59	0.04	4
6	90	11	1.19	1.84	0.03	0.23	0.63	0.23	0.65	0.05	5
7	108	13	1.28	2.97	0.06	0.30	0.72	0.30	0.71	0.06	8
8	135	17	1.38	5.10	0.13	0.43	0.81	0.43	0.78	0.08	15
9	219	24	1.71	8.62	0.36	0.62	0.90	0.62	0.85	0.12	30
10	1549	70	4.06	45.24	1.00	1.00	1.00	1.00	0.99	0.92	94

Number of active gages divide in each percentile

Percentile	Elev	Slope	PPT	StreamDen	GeoAluv	GeoCoarse	GeoFine	GeoRock	Forest	Wet	Imperv
10	1	13	0	23	0	0	50	0	44	11	47
20	3	26	2	31	0	27	40	27	48	12	45
30	5	33	2	62	0	34	31	34	33	7	16
40	6	27	42	73	73	31	24	31	28	11	21
50	13	17	28	32	36	35	23	35	26	14	18
60	15	18	25	35	48	42	30	42	20	18	13
70	33	13	30	13	45	28	19	28	21	16	27
80	36	22	18	6	38	27	21	27	33	28	13
90	44	25	32	2	28	31	27	31	17	42	38
100	122	83	99	2	11	24	14	24	9	120	41

Percentile classes with less than 10 active gages have gray fill.

All gaged basins have some alluvium (>0)

Attributes that are not well represented by gages:

- low elevation (<60 m);
- low precipitation (< 1 m);
- high stream density (>5 km/sq km)

Active gages for regional streamflow monitoring

199 gages cover at least 10% of an AU and the AU is at least 10% of the incremental drainage area* of the gage

*Area between the gage and next upstream active gage.

Gages that cover at least 10% of an RSMP area where the RSMP is at least 10% of the incremental drainage area

GageNum		Agency	RSMP
1	Kelsey Creek at 148th Ave. NE	City of Bellevue	1879
8	Coal Creek at Orcas Key	City of Bellevue	391
15	Whatcom Creek	city of bellingham	9552
45	Longfellow Creek at 24th Ave SW & SW Willow St	city of seattle, dpw	11399
109	Judd Creek, Vashon Island	King County	1235
171	Little Soos Creek at SE 272nd	King County	10563
227	Upper Fennel Creek at Kelly Lake Rd.	Pierce Co	398
236	Clover Creek at A Street	Pierce Co	13838
236	Clover Creek at A Street	Pierce Co	7518
247	Scriber Creek at Oak Way	Snohomish Co	15067
253	Skookum Creek	Squaxin Island Tribe	1550
264	Dungeness River at Dungeness	USGS	831
317	Goldsborough Creek abv 7th St. at Shelton	USGS	222
326	Deschutes River nr Rainier, WA	USGS	1702
347	Nisqually River at McKenna, WA	USGS	1590
354	North Fork Clover Creek nr Parkland	USGS	2574
356	Clover Creek nr Tillicum	USGS	4026
380	Puyallup River at Alderton, WA	USGS	1002
414	Unnamed Crk at Salt Water St. Park nr Des Moines, WA	USGS	451
450	Mill Creek at Earthworks Park, at Kent	USGS	14419
488	Issaquah Creek nr Hobart	USGS	2259
500	Cottage Lake Creek abv Bear Creek, nr Redmond.	USGS	13031
508	North Creek below Penny Creek, near Bothell.	USGS	859
513	Swamp Creek near Alderwood Manor.	USGS	3691
554	Boxley Creek nr Cedar Falls	USGS	11059
554	Boxley Creek nr Cedar Falls	USGS	9443
573	Cherry Creek near Duvall.	USGS	1995
594	SF Stillaguamish River at Granite Falls, WA	USGS	1924
688	Anderson Creek near Bellingham.	USGS	5456
734	California Creek at Valley View Road	WDOE	1776
753	Big Beef Creek at Holly Road	WDOE	1639
757	Gorst Creek at Gorst	WDOE	10503

Summary

Most (199/279) of the active gages in the network are likely to be useful for regional monitoring.

About 1/3 of RSMP sites have gages upstream or downstream that are likely to be useful.

A more rigorous definition of useful would reduce these numbers of gages, but requires specification of how the information will be used.

Low elevation areas are under-represented in the streamflow gaging network